(a) The Modern Treatment of Tuberculous Diseases of the Joints.

(b) The Modern Treatment of Club Foot.

Being the opening speeches in these discussions in the sections of (a) Surgery, (b) Diseases of Children, at the Annual Meeting of the British Medical Association, held at Belfast, 1909.

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The Modern Treatment of Tuberculosis.

Mr. President and Gentlemen,—Surgeons of large experience in the treatment of joints must needs be struck by the differences which tubercle exhibits when it affects the adult as compared with its behaviour in the young. In the child, under suitable control, its progress is benign ; in the adult it is intractable and infinitely more grave. It is very many years since I have had occasion to excise a joint in a child, while I constantly, at a comparatively early stage, operate on the adult. In a child an early excision is not justified by our experience of the clinical history of the disease, while a late excision is useless, an amputation being usually needed. Either an early or a late excision in childhood, to be mechanically effective, will involve serious interference with subsequent growth. We occasionally see, even yet, the shortened and frequently flail limbs which resulted from the operative surgery of over twenty years ago, before the teachings of the late H. O. Thomas, of Liverpool, had brought about a change in practice. In the adult, general dissemination is more apt to occur, time is of more importance, and operative result is mechanically more effective. It means an earlier and more complete fixation of joint than Nature laboriously

and often unsuccessfully strives for. Operations with the object of preserving function are rarely possible. Without laying further stress on this point I will chiefly direct your attention to tuberculosis in the child.

Certain chronic infective articular affections simulate tubercle, but this is the case much more often in the adult than in the young. In such cases, for the purposes of diagnosis, reaction to the New Tuberculin is fairly reliable, while radiography is of little use; indeed, in many instances the discovery by exploration of the staphylococcus, streptococcus, or pneumococcus is essential to diagnosis. To begin with, I would draw attention to the interpretation of the important sign we call rigidity and the comparatively unimportant symptom—pain. Rigidity is the very early sign, and may be ascertained before there is any evidence of muscular shrinkage. In arthritis, no matter what the joint, the rigidity affects it in all directions—flexion, extension, abduction, adduction, and rotation. In a suspected joint if there be no limitation of movement there is no arthritis. I have come to look upon this as an axiom, as the exceptions to the rule are so extremely rare. In early cases the rigidity must be examined for without an anæsthetic, as it is primarily due to muscular action: later, contractures or muscular shortening will follow as secondary effects, but by this time a diagnosis will be obvious. As an illustration we will take

the case of the spinal column. A boy complains of pain in the centre of the spine. The surgeon asks him to flex, extend and laterally bend it, which he is able to do. We can therefore exclude a spondylitis. Another boy may be tender over the spine, have great difficulty in flexing his column, but he can hyperextend it with ease, and here again we can place to one side our suspicion of tubercle. In a third case, the spine is rigid in all directions, and this symptom is quite in accord with a tubercular lesion. This general rigidity is more reliable than any single symptom, or any single group of symptoms. Pain, as evidenced by pressure on the vertebral spines is hopelessly unreliable, and, if present, is an argument against rather than in favour of a Pott's lesion. The same is true of all other joints. A youth complains of swelling and stiffness of a joint which he cannot fully flex, but he is able to fully extend : we may be sure he has no tubercular trouble. I would desire to press the point, therefore, that in arthritis the movements of a joint are limited, not in one, or some, but in all directions. Pain, so often referred to, is neither a constant nor a valuable symptom, and in a tubercular joint is often practically absent from first to last. Our text books are very silent as to any tests whereby we may judge of the recovery of joints, and yet it is very important if our treatment is to be effective that we should possess some reliable data as to when treatment should be discarded.

This lack of definite instruction is the source of many so-called relapses. We may conclude that a joint has recovered from its disease when its range of movement is not diminished by subsequent use, or, if the joint be ankylosed, where its position does not alter by use. For instance, an elbow joint has been slung up at an acute angle until the surgeon thinks it may be well. He then lengthens the sling two or three inches and notes the result. If the patient's arm has shortly dropped these inches, and he can voluntarily raise it back again, recovery with movement may be predicted. If the arm stiffens in its new position disease is still active. If it does not fall from its acutely flexed position to the lowered sling then a recovery by ankylosis has been attained. Similarly in other joints. A knee which has been kept fully extended and at rest is released. Should it begin to flex and stiffen it is still unsound. Should it remain fixed and extended it is a sound ankylosis ; if it should both flex and straighten ever so little it is a sure sign of recovery with movement. In the hip, the most convenient test is that of flexion. If the patient leaves with a flexion of 20° and returns with one of 40°, then recovery has not taken place. The test of recovery is, therefore, based upon a careful experiment, and the cautious surgeon will so conduct that experiment that all unnecessary risk may be avoided. I have always advocated that tubercular joints in the young should be treated by complete rest, open air, and

good food. The more I see of the disease in my own clinic, and in those of others, the more assured I am of the paramount value of rest. The more complete the rest, other things considered, the more benign is the course of the affection. The joint should be rigidly fixed in an appliance and weight bearing denied. Traction or extension should be looked upon as an inferior method of procuring rest. Efficient fixation without traction will very soon govern muscular spasm. Traction may, of course, be used to correct deformity, but there are more effective ways of doing this than by weight and pulley. I place great importance upon keeping tubercular children in the open air, and have for many years refused to admit them into a town hospital excepting for the short time necessary to rectify deformity. They do infinitely better lying out of doors in a slum than indoors in a mixed ward in even the most sanitary of town hospitals. I happen to work at institutions where (*a*) tubercular children are indoors all day; (*b*) where they are out several hours a day; (*c*) where they are out all through the day; and, lastly, (*d*) where they are out by day and by night. My experience is entirely favourable to the maximum of open air. This fact is happily being generally recognised abroad, and doubtless in time all tubercular and most other children will be treated outside. The days of children's hospitals in town are numbered. The children of the poor can be kept lying in the open on an

improvised couch, chained to the railings if there be no one to act as nurse. The windows of their sleeping apartments should be open all night. An immediate result of sleeping in the open is an increase of appetite, and specially generous diets should be given. At Baschurch, one of the institutions above referred to, excellently cooked food of unusual variety is given without limitation. The children are encouraged to eat, and it is inspiring to note their rapid physical development.

The splints used should be of the simplest kind and should be so devised as to minimise or prevent deformity. In the hip the limb should be secured in the extended and abducted position. This will mechanically remedy any shortening due to arrest of growth or displacement upwards of the head in spondylitis. The spinal column should rest on a convex surface to prevent angular flexion. When we recollect the site of disease in front of the vertebral bodies and the subsequent telescoping that occurs, the value of this position will be apparent. The ideal position for the shoulder is a lateral one at an angle of 45° from the body, in order to secure better abduction. The knee should be kept extended and the elbow according to the ultimate needs of the patient, while every wrist should be kept hyperextended. The hyperextended position is of great importance in the treatment of the wrist, and yet it is invariably treated on a straight splint, which result in ankylosis in a somewhat flexed position. If one wishes to grip powerfully,

the wrist is first instinctively extended. One cannot grip effectively with the wrist flexed or straight. If disease at the wrist be directed to ankylosis in the extended position, every advantage will accrue to the patient's power of grip. So true is this that when a patient comes with flexed and stiffened wrist and faulty fingers, I attack the ankylosis with a wrench and place the wrist in full extension. In ankle joint trouble, especially where the mid-tarsal joint has been involved, the ankle should be fixed in such a position that the heel should first impinge upon the ground. We nearly always find it stiffened in a position which prevents the heel from touching the ground. This is wrong, for at every step the patient takes a cross-breaking strain is cast upon the joint. Ankylosis is so commonly the result of treatment that we must always study the most useful position for a stiff limb.

Should abscesses present, what are we to do ? In days gone by I used to open up and drain nearly every abscess cavity I could find, this irrespectively of any symptoms that were present. Since then I have employed incision and immediate suture, aspirations, and the injection of a variety of emulsions, including the creosote and camphor napthol of Calot. The experience of such cases with those treated expectantly has convinced me of the value of leaving certain types of tubercular collections alone as long as possible. I disregard them if they give rise to no symptoms. They are

only serious or urgent if they are infected from within or without. It is a mistake to attach the clinical importance to a tuberculous abscess that we do to a collection of pus. The tubercle bacillus is not pyogenic. Where true suppuration occurs it is due to a secondary infection. Efficient fixation undoubtedly lessens the liability to abscess formation, and also facilitates their disappearance. In a well immobilised spine quite a large proportion of these abscesses disappear. Writers who do not observe this obviously never give time for it to occur. In the hip joint they are especially apt to become nomadic, changing their residence from within the joint to residence without. They become extra-articular in the sense of having no connection with the joint. Often I have noticed collections having appeared from the joint travel down the thigh, become isolated and then gradually dwindle away. The process of absorption is not characterised by any clinical manifestation. I refuse to open tubercular abscesses early, not because I dislike a radical operation, but because an operation is necessarily incomplete and ineffective if it cannot remove the disease of which the abscess is but a symptom. If opening the abscess meant the eradication of disease, clearly the problem would be solved.

In many cases, however, the abscess is not absorbed, but travels towards the skin. An abscess which forms early in tuberculous disease and is evacuated is, in my opinion, a more serious affair

than the abscess treated in this later stage. Aspiration will here prove of value, and this may have to be frequently repeated. Usually, however, I prefer allowing the abscess to invade the surface, when I make a small puncture half an inch in length (or less), using the strictest precautions, scrupulously avoiding the Volkmann's spoon or irrigator, for I do nothing to interfere with the thick sac wall which provides so admirable a barrier against infection. If these abscesses be attacked in this way the terrors of infection are assuredly much diminished, for the delay of many months in opening the abscess has given the joint time to make progress, the supply of debris is shut off, and the long exhaustive discharge which follows early incision is curtailed. I have no conviction more settled in my mind than that of the value of a conservative attitude towards tuberculous abscesses. When we remember that hospital surgeons, with all the facilities for the practice of a rigid asepsis, see only an infinitesimal proportion of these cases, and that the overwhelming number are in the hands of practitioners in slums and country places, handicapped by their environments, totally unable to insist on surgical cleanliness, the policy I advocate seems to me of great importance. My experience warrants me in saying that numbers of children die in all parts of England and Wales because we do not realise the many responsibilities involved in the routine opening of tuberculous abscesses.

If, however, with the presence of fluid, discomfort, pain and temperature are present, or if the patient rapidly or steadily declines in condition, then the abscess may be suspected and attacked by good incision, bone searched for and antiseptic irrigations adopted. Here there will be found a mixed infection, and surgical interference is urgent and most effective where most radical. Again, for geographical reasons a retro-pharyngeal abscess demands immediate incision, preferably behind the sternomastoid, and in those rare instances of collections in the posterior mediastinum where one finds spasmodic attacks of dyspnœa, evacuation should be immediate by costotransversectomy over the affected articulation.

The treatment of deformity in the presence of disease cannot be stated authoritatively. One can only tell one's belief and practice. However heretical it may appear I invariably reduce deformities in whatever stage of the disease they may be presented to me. In the so-called acute stage this is easily accomplished, in the more chronic case with pronounced flexion it is less easy ; in firmly ankylosed cases still unsound, osteotomies may be needed. However the reduction be effected, complete rest for a considerable period should follow in order to control reaction. We must remember that sinuses will continue to discharge after Nature has quite immobilised the joint, and such prolonged discharges are invariably of mixed infection. The recent introduction of

bismuth in such cases is valuable both as a means of diagnosis and treatment. For diagnostic purposes a sterile mixture of bismuth subnitrate one part, and vaseline two parts, mixed while boiling, is injected into each sinus and the track radiographed, preferably by the stereoscopic method. By this means the disease can often be focussed in old cases which are recovered of all but their sinuses. Careful observers have reported exceedingly well of the treatment of such sinuses by the injection of bismuth paste. It is composed of bismuth six parts, white wax one part, vaseline twelve parts. This treatment is more favourable in ramifying intricate sinuses not complicated by active bone disease, a class of sinus much more common than supposed. This type of sinus is more frequent in the adult than in the child and is often the only argument upon which the diagnosis of active disease is founded. In such cases in the adult, accompanied by marked flexion and adduction at the hip, with a thick mass of bone in place of the femoral head and neck, I have often to correct deformity. The patient may have five inches or more of shortening with sinuses which have lasted years. In such a case an osteotomy is not adequate, and a wedge must be removed by open incision. Traction applied to the hip, with the necessary forcible manipulation in the presence of a large open wound, is a severe procedure, and to minimise risk it is well to divide the operation into two stages, with an interval of a fortnight.

The first stage should consist in removing a wedge from the femur, leaving about a fourth or fifth of the diameter intact. The wound is then allowed to heal, when the second operation is performed. This consists of simply fracturing the limb. A somewhat severe operation is thus reduced to quite a simple one, and traction can forthwith be harmlessly applied. Subcutaneous division of the adductors is generally demanded where abduction of the limb is desired.

Although we are not called upon to discuss the treatment of cured but deformed tubercular joints, I would offer a suggestion in reference to a problem often put to me. An ankylosed adult knee is presented, supposed to have recovered from tubercle, but more often of septic origin. An X-ray shows a barely appreciable damage to the bony contour. Is it safe to endeavour to bring about movement ? If the case is otherwise suitable a careful experiment may be made. Should the knee present say an angular deformity of 15° a splint should be affixed presenting an angle of 20°. The limb should be gently forced and bandaged to it for about ten or fourteen days. The splint can then be removed and the limb left loose in bed for a week or so. If any additional movement exists a good prognosis may be given and the treatment can be safely and more actively proceeded with. If it remain stiff, to persevere may end in disaster. To break down such cases, as a bonesetter would, or to endeavour

to enforce "passive movements," would be a highly hazardous adventure.

Sir William Macewen has referred to tuberculin and to passive hyperæmia, and on these subjects I should like to add a word of warning. The disciples of Bier, Wright, Marmorek and others, if they are to do good service, should exercise moderation in the carrying out of their views. It is a mistake to imagine that any single one of them possesses the whole truth. I have already seen many tubercular children deprived of their splints for many weeks while undergoing one or other course. The results have often been disastrous and sometimes even tragic. This will surely often recur until all who adopt and practise these methods make a closer clinical study of the natural course of disease. Tuberculin can be given, or hyperæmia applied, without discarding the positive advantages derived from the prevention of deformity and the breathing of country air.

The Treatment of Club Foot.

Mr. President and Gentlemen,—Although the term "club foot" is used to denote nearly all distortions of the foot, either acquired or otherwise, it has been wisely decided to exclude from discussion the paralytic type. Of the congenital varieties equino varus is the only one of serious clinical import. Pure varus and valgus are extremely rare, and the treatment of talipes calcaneo valgus is one of the simplest of propositions.

The primary distortion of equino varus is a dislocation inwards of the anterior part of the foot at the medio-tarsal joint. It varies largely in the same case during the process of growth, and it varies according to the severity of the deformity. There are certain elements, however, almost constant. The scaphoid articulates with the side of the head of the astragalus instead of with its anterior surface; it also lies more towards the underside of the astragalus and thus leaves the astragaloid head abnormally uncovered. The cuneiforms and metatarsals follow the direction of the scaphoid. The cuboid is displaced upwards and inwards and may be generally found lying to the inner side of the anterior part of the os calcis. The astragalus later is depressed anteriorily and

more wedge-shaped than normal. It is plantar flexed, so that much of its body lies anteriorily. Its neck is generally longer than usual; it is depressed and displaced inwards. The os calcis is in the position of plantar flexion, and it lies beneath the astragalus instead of to its outer side. In a large proportion of cases there is an inward rotation of the tibia and fibula, so that the external malleolus presents in front of the tibia. This last is an important point to remember, and I shall refer to its clinical bearings later. The ligaments and muscles on the concave aspect are shortened and resistant; the adductor and flexor group being relatively stronger than their lengthened and overstretched opponents. In the less advanced cases the most obstructive structures are the plantar fascia and the ligaments which bind together the os calcis, astragalus, and internal malleolus. The muscles which are shortened and tend to increase the deformity are the tibialis anticus, posticus, the gastrocnemius, and the soleus. These changes as they exist in the recent talipes may be comparatively slight, but later on as the foot develops, and more especially when walking is commenced, the bones participate with the increasing deformity in making fixed and inflexible the inturned foot.

In consideration of the short time at my disposal, I may be pardoned if I state my own procedures as regards treatment rather than discuss the methods of others. The surgeon who has

successfully worked on certain lines may be a little prejudiced in his presentment of other means—most of which will doubtless be elicited during our discussion. Believing, as I do, that with appropriate early treatment grave operative procedures would never be needed, I shall largely confine my remarks to the treatment of the early case. We, of course, constantly meet cases where it is expedient to attack bone. Such cases, however, involve neglect on the part of the parents or insufficient treatment on the part of the practitioner. If one has been given a free hand in the treatment of an early talipes, there is no manner of excuse for failure and the so-called relapsed or intractable case should never result. Two important questions greet us at the onset. When shall treatment start and when shall treatment end ? The treatment should begin at birth and should not end until the little patient can voluntarily hold his foot everted and ankle flexed. Treatment should begin at once, for there is no class of cases which more bitterly resents procrastination or insufficient handling. We must be taught to realise the responsibility which rests on anyone who postpones the immediate treatment of club foot. The blame cannot be thrown on the midwife, for invariably she calls medical attention to the defect. To any surgeon of practical experience of this deformity it is most necessary to state that a baby of one day old is an infinitely easier problem than that of a month

old, and that very often the treatment of a child at three months may require very skilled and forcible effort. I emphasize this the more as, even yet, we have authors who mischievously write of six weeks and ten months as a suitable age to begin treatment. I have never seen a case of club foot where treatment has been started in the first week where the deformity could not be completely rectified by manipulation and retention in two months. Such cases have not voluntary power in the overstretched muscles for a much longer time. This is due, however, to physiological reasons in connection with the elongated tendons and not to rigidity of the foot.

It is customary for the text books on orthopædic surgery to allude to four or five classes of cases. The first includes the cases which can, by very mild manipulation, be easily rectified; the last would comprise the adolescent, untreated, so-called intractable case. This merely means that cases are met with in every stage and obviously must be overcome by various and diverse methods. It is to be remarked, however, that one child a day old may present much more formidable deformity than another of the same age, but we should at once be able to predict an easy or a difficult course.

The simple case is the one which we can quite easily replace in good position, and which shows but little adduction at the mid-tarsal joint. Such a case may not require a division of even the

tendo Achillis. If, however, there is a marked adduction at the mid-tarsal, and a rotation inwards of the tibia and fibula, considerably more difficulty will be experienced. In the simple case the tibia and fibula should be grasped at the epiphysis and the foot should be alternately everted and flexed. In all manipulations for club foot the epiphysis should be grasped tightly to avoid strain. Following eversion and flexion the heel should be grasped in one hand and the anterior portion of the foot in the other, and abduction secured at the medio-tarsal joint. Five minutes spent three times a day in doing this should be followed by gentle massage of the flexors and peronei. Then comes the application of a bandage or of a rectangular splint. Few seem to appreciate how much can be done by the mere application of a calico bandage. To invert a foot the bandage would be started on the outside, to evert on the inside. In the case of equino varus it should start on the inner side of the ankle, pass under the sole of the foot over the front of the ankle and so evert it. Every turn of the bandage so applied pulls the foot upwards. I have on several occasions, for demonstration purposes, in cases of moderate severity, completely overcome pronounced deformity by the simple expedient of a bandage. Care should be taken if a bandage be used, with or without a splint, not to carry it much above the ankle lest the muscles be thereby weakened. In these early simple cases, when frequent

manipulation is employed without retention, an intelligent nurse can be easily taught to lighten the labours of the surgeon. Should the surgeon be able with but little effort to restore the foot to a right angle, division of the tendo Achillis will not be needed. Should the degree of resistance be more marked, division is to be preferred. In such cases I correct the varus and the equinus at one sitting. I begin by placing the foot in a sterile wrap and lever it at the mid-tarsal joint, in obstinate cases using a block to increase the force. When the adduction is completely corrected I divide the Achillis tendon and fix the foot in a retention splint. A good deal has been written of the advantage of correcting the varus and at a later date attacking the tendon. Although in full possession of the arguments for this view I do not subscribe to them, and I know from abundant observation that the tendo Achillis becomes a powerful invertor of the foot. This is due to the altered position of the os calcis, and if you examine a case of club foot you will generally find the Achillis tendon displaced inwards, the extent of displacement being proportionate to the severity of the inversion of the foot. This factor of inversion seems to have been quite overlooked, and yet it has a very important clinical bearing. So marked is this displacement in certain cases that I have divided the tendo Achillis longitudinally and separated one-half of its insertion, passing it under the outer half of the

tendon and affixing it to the outer half of the heel. For a simple division of the tendon the seat of election should be well above the insertion to avoid the fan-like expansion. The division of the tendon is often done in very bungling fashion. It is necessary to discard the dangerous old-fashioned knives, which even yet adorn our text books, and to use small bladed tenotomes such as these I show you. The child should be made to lie on its face while a nurse flexes the good limb well out of danger. The position of the tendon can be felt with the handle of the knife and an indentation made with it in the skin to denote its position. The surgeon holds the foot with the left hand in an extended position, and enters his knife to the inner or outer side of the tendon denoted by the indentation made in the skin. The foot is then slackened while the blade is turned beneath the tendon, then extended so that by a short sawing movement the tendon is divided upwards. This short sawing movement is an effective safeguard against dividing the skin, an accident very common in the hands of a beginner. At this point another problem arises. Having divided the tendon, should the foot be at once placed at right angles to the body. There is no object to be gained, only valuable time lost by the gradual separation of the ruptured tendon. The fear that union may not take place is groundless. I have divided the tendo Achillis many

thousands of times and only once do I remember a failure of union. The foot should be forcibly flexed by means of the hand or wrench, and at this stage we should satisfy ourselves as to the presence or otherwise of rotation inwards of the tibia and fibula. We will all have noticed that in many cases, where flexion and inversion have been corrected, when our patient walks there seems to be a rotation inwards of the leg. There has been much discussion as to the site and cause of this rotation, and many theories have been promulgated, but I am convinced after examining many cases that, with rare exceptions, it occurs entirely below the knee. In old cases, where this rotation complicated the result, I advocated osteoclasis for its correction as a substitute for girdle bands and other complicated and hateful machinery. I would urge, however, that this calamitous complication be frustrated at the outset. From the moment treatment is started the malleoli should be grasped in one hand while the leg should be held below the knee with the other. The lower hand rotates outwards and the upper inwards. The leg is thus twisted in its long axis by an action not dissimilar to that used when one wrings a wet cloth. If this be done each day, by the time the foot is straight the rotation of the leg will also have disappeared.

In cases which come to the surgeon for the first time at three or four months old, other operative procedures may be needed in the form

of subcutaneous division of any tightened soft structures. This may include the plantar fascia, the two tibial tendons, the anterior fibres of the deltoid and any deep plantar ligaments. The anatomy must not deter the practitioner who is outside the call of help. It is far better to divide any of the tendons, with the artery as well, than to seriously delay treatment. In my long experience I have divided many structures best avoided when performing tenotomies, but no appreciable harm has ever followed. In this the more severe type of case, ranging from three months to four years, I supplement manipulation by the use of a Thomas' wrench. Thomas himself very seldom tenotomised more than the tendo Achillis, and he effected the restoration of the foot by intermittent stretching and retention in an iron shoe. It is applicable to any degree of deformity in young children and the ultimate results are excellent. There is much to be learned as to the use of the wrench. The twisting and bending is done forcibly and quickly, and the foot immediately released lest the skin be injured. The wrench should tightly grip the foot so that it does not slip and make a sore. In older children the surgeon's hands should grip the epiphysis while the wrench is worked by the hip. In this way a steady and easily controlled force is applied. The wrenching should be conducted every day or every alternate day for three weeks, and each time should be carried far enough to temporarily destroy the

resiliency of the soft parts. I use a club foot shoe, such as I show you, modified from that used by Thomas, in order to produce better eversion. The details of its application, simple as they appear, require study. After the foot has been manipulated into the best possible position, a piece of plaster should be started on the dorsum and given to an assistant to hold. He should be directed to pull at right angles to the leg whilst the surgeon, or one he can trust, places the retention splint in position ; this should be done every day for six weeks. I much prefer this method to plaster of Paris, although in the case of hospital patients the less troublesome fixation is inevitable.

At the end of two months the most troublesome cases of this class (i.e., cases which the surgeon sees during the first two or three years) should present a pliable foot which can be placed into normal position without encountering resistance, and if the child be sufficiently old he can be taught to walk in such a manner that each step he takes tends to improve the shape of his foot.

No case of talipes equino varus can be pronounced cured until the patient has tested it by walking. Surgeons think that as soon as they are able without effort to hyper-correct deformity the case is cured. This is a serious fallacy May I impress upon you, for text books do not state it, that no case of club foot is cured until *the patient*

can voluntarily raise his own foot from the *deformed into the corrected position.*

I should say that there are three causes of so-called relapse in club foot.

1. Insufficient correction of deformity.

2. Erroneous deflection of body-weight on tarsus when walking.

3. A slack and lengthened condition of muscles due to overstretching.

If the deformity be not sufficiently corrected in the first instance the old condition of things is sure to return, because of the altered shape of bones and structures, more especially the ligaments. Roughly speaking, the change in bones and ligaments on the convex aspect of a talipes has resulted in an increased surface measurement. Unless this is quite obliterated by treatment the unequal growth goes on until the so-called "recurrence" again taxes our resources.

We have before said that no case should be looked upon as cured until walking has been practised. In other words, we mean that the foot, when the time for walking comes, will either be made worse or perfected by this exercise. If it be made worse, it is due to the fact that the superincumbent body-weight is placed too much to the outer side of the tarsus, and that therefore every step the patient takes tends to emphasize the varus. One can see how deleteriously walking would affect such a case. Walking should give the finishing touches to the surgeon's art, and

should not be allowed until the body-weight at every step tends to flatten the plantar arch.

The effect of lengthened muscles opposed to deformity is very obvious, and when one realises the fact that in every case of club foot the peronei and flexors of the ankle have for months remained in a stretched condition, while the tibials and calf muscles are short and unstretched, it is easy to understand the imperfect recovery where no attention is paid to the strengthening of the weak group of muscles.

The flexors of the ankle and the peronei, which have for so long remained overstretched, behave to all intents as paralysed muscles would, and gravity decides the issue exactly as it does in the case of an equino varus due to poliomyelitis. When the patient has arrived at the age for walking and the deformity is corrected and, most important of all, when he can voluntarily evert and flex his foot, he should be taught to walk. Correct deflection of body-weight on the tarsus must, however, be assured. This is best done by a simple device which I show you. It consists of an iron bar (called a flapper) which skirts the outer side of the sole, and the foot, aided by this and an inside iron to which it is bandaged, keeps everted during walking.

By means of this little addition to the boot and the iron on the inner side of the leg, the body-weight is deflected from the outside of the tarsus to the inside. Every step, therefore, the patient

takes corrects, howsoever little, any tendency that may remain towards inversion. The nurse should further be instructed to train the child to walk with out-turned toes in order that body-weight be employed in stretching the deltoid ligament on the inner side of the ankle. During the whole course of treatment massage of the flexors of the ankle and of the peronei, together with resistance exercises, should be practised and every effort made to render flexible and pliant the mid-tarsal joint.

Although deformity, even to an adult age, can be rectified by forcible means, it is often advisable to resort to bone operations. Every year I operate upon twenty or thirty such cases. I have no time even to name the many operative procedures described, but I should like to dwell upon a certain point which should be observed before any operation involving the removal of bone be performed. It is this, that a preliminary stretching following tenotomies should precede the more radical operation.

This is a matter of considerable importance. Before removing bone in a patient of any age, the foot should be placed in the very best position by means of wrench and tenotomy, and retained there in splints for a week or more. The operative result in consequence of this preliminary will be much more artistic and will involve far less sacrifice of bone.

If the bone operation is decided upon I

usually make a longitudinal incision at the outer aspect of the dorsum of the foot, its centre being over the prominent head of the astragalus. The extensor tendons of the toes are retracted to each side of the wound, the mid-tarsal joint is opened up and a good view of the astragalus and cuboid is obtained. In some cases I remove a large wedge, the base being to the outer side. This involves the astragalus and cuboid and part of the scaphoid. Enough must be removed to bring the foot into an overcorrected position, otherwise some return of deformity will take place during growth. Of late years I have improved upon this procedure and I now remove practically the whole of the astragalus, only leaving the superior articular surface for articulation with the tibia and fibula. In order to do this I scoop out the cancellous tissue with an arthrodesis gouge, remove part of the cuboid and scaphoid as before, and run the chisel through any other portions of bone which prevent easy eversion. By this operation one overcorrects adduction at the mid-tarsal joint, and in this way growth of the deformity is obviated.

Conclusions.

The treatment of club foot should begin at birth and should not end until the patient walks.

That early treatment should be an assurance of complete recovery without any operation on bone.

That the mechanical treatment of the rotary deformity of the tibia and fibula should be synchronous with that of the equino varus.

That the test of recovery is the voluntary power to flex and evert the foot.

That the relapse may be due to inefficient correction, to slack extensor tendons, and to erroneous deflection of body-weight during walking.

That when bone is to be removed a preliminary forcible correction of deformity by tenotomy and wrenching both simplifies and perfects the operation.